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English 201

V00989986

Word Count: 2006

Apr 8, 2023

**Unintended Consequences: The Impact of Invasive Species on British Columbia's Ecosystems and Economy**

Imagine strolling through your favorite park in British Columbia expecting to see familiar native plants or animals, but instead, you find them replaced by foreign species. This is not a sci-fi plot, but a pressing reality - the invasion of non-native species in our ecosystem. These invaders, whether hitching a ride on commercial vessels or introduced for hunting, have infiltrated our local habitats. Some have coexisted with native species, while others have become invasive, disrupting our ecosystems' delicate balance and posing significant ecological, economic, and health challenges. But why should we be concerned about these uninvited guests? And what can we do to halt their spread? Exploring these questions and drawing from a range of perspectives will shed light on the complex problem of invasive species. Views from Dr. Jichul Bae, a committed weed scientist, alongside authors Natascia Tamburello and Aline Litt who champion a comprehensive approach to managing invasive species, and the province's strategy based on risk assessment will all be explored. The effects of these unwelcome intruders will be examined, as will the immediate necessity for alert, knowledgeable, and cooperative actions to put a stop to their invasion and protect British Columbia's native wildlife and the ecosystem they live in.

Numerous foreign species, intentionally or unintentionally introduced, have taken over a range of ecosystems in British Columbia. You may wonder how these species managed to reach British Columbia. There are numerous pathways for this to occur. For instance, marine species could have stowed away in ship ballasts or with commercially transported oysters. Additionally, species like the American Bullfrog might have been introduced for activities such as hunting, fishing, or consumption. Species like the Wild Turkey and Virginia Opossum, have spread from the US into British Columbia, therefore it was impossible to predict their invasive behavior. Regardless of their origins, these alien species are now part of our local habitats, having established themselves in our ecosystems, with some becoming invasive and displacing native species. While the introduction of these foreign species into British Columbia was often unintentional and unpredictable, their impact has been far from harmless. The consequences of their presence are felt across our ecosystems and economy.

They also present considerable challenges in British Columbia due to their potential to disrupt local ecosystems by outcompeting native species for resources. This can lead to a decrease in biodiversity as native species are displaced or even driven to extinction. Economically, these invasive species can negatively impact important industries such as forestry, fishing, and agriculture, leading to significant financial losses. Furthermore, certain invasive species may pose health risks to both humans and animals, adding a further layer of complexity to their management and control. In essence, the balance of nature is critical, and invasive species have the potential to severely disrupt that balance.

Dr. Jichul Bae, a weed scientist at Agriculture and Agri-Food Canada (AAFC) in British Columbia, has devoted his career to understanding and managing invasive plant species, which he views as a fascinating puzzle rather than a mere problem. His interest was sparked by an engaging university class, leading him to specialize in this field during his Ph.D. at McGill University. Upon joining AAFC’s Agassiz Research and Development Centre in 2017, Dr. Bae made it his mission to test herbicide resistance, aiming to transform weed science in the province. This was driven by the need for more tailored strategies for weed control in British Columbia, given its unique climate and species. One of Dr. Bae's significant contributions is the establishment of a team and lab in 2020 dedicated to testing weeds for herbicide resistance. They collect samples of weeds, expose them to different herbicides, and observe whether the plants survive or die. This can indicate a resistance or susceptibility to the herbicide. In some cases, they delve into the DNA level to identify any mutations or resistant genes. This meticulous approach to weed science provides valuable information for growers, offering insight into alternative weed management strategies that are more environmentally friendly and cost-effective. By sharing this knowledge, Dr. Bae is helping to shift the approach to weed control from repeated herbicide application to more sustainable practices. In summary, Dr. Bae's perspective emphasizes understanding the nature of weeds and their resistance to herbicides and using this knowledge to develop more effective and sustainable weed management strategies.

In the article “Multiple impacts of invasive species on species at risk: a case study in British Columbia, Canada,” authors Natascia Tamburello and Aline Litt focus on addressing the growing threat of invasive species, a leading cause of global biodiversity loss and species extinction. The authors critique the current single-species management approach, arguing it leads to inefficiencies and obstacles in achieving desired outcomes. They propose a more holistic approach that maps the relationships between invasive species and species at risk, which they illustrate through a case study in British Columbia, Canada. The study uses a three-step screening process. The first step filters species at risk where invasive species have been identified as a key threat. The second step confirms documented threats by invasive species within British Columbia. The final step focuses on species at risk impacted by at least one invasive species that is also included on British Columbia's Provincial Priority Invasive Species List. The number of invasive species has drastically increased over the past 50 years and is projected to continue growing. This study employs a systematic selection and screening process to identify species at risk.

The researchers begin by reviewing data from previous studies that identified invasive species as a significant threat to certain native species. They then narrow down the list of species at risk based on their range, focusing on those within British Columbia and/or the Pacific Ocean. The study results show that out of 169 species at risk in British Columbia, 92 are impacted by at least one Provincial Priority Invasive Species. Ultimately, the authors are advocating for a shift from single-species management to a more holistic approach that considers the broader ecological context, arguing that this will provide a stronger foundation for reducing or mitigating the threat posed by invasive species.

When it comes to the government's perspective and priority when tackling these invasive species in British Columbia, a science-driven risk assessment process is used, which prioritizes invasive species at a provincial scale. Management actions are then determined based on these priorities, available resources, and treatment methods. The most effective strategy for controlling invasive plants is seen as preventing their initial introduction, establishment, and spread over ecosystems. This process includes partnering with land managers not just in British Columbia, but across North America and even internationally. It also involves carrying out comprehensive inventory projects and preparing available risk assessments. When an invasive species is first detected, it's handled via the Provincial Early Detection and Rapid Response program, which evaluates the risk to the province and explores the different possibilities when addressing these foreign species. For already well-established invasive species, the level of priority given to them can differ, depending on factors like their geographical location or the specific dangers they pose to native species in particular regions. The British Columbia Inter-Ministry Invasive Species Working Group and the Provincial Government’s Invasive Species Specialists have developed management categories for invasive species. These categories are based on a provincial scale and do not consider local or regional criteria.

**The categories include:**

**Prevent:** High-risk species not yet established in British Columbia. The objective is to prevent introduction and establishment.

**Provincial Early Detection and Rapid Response (EDRR):** High-risk species new to the Province. The objective is eradication.

**Provincial Containment:** Species that pose a high risk, have a limited presence in British Columbia, but carry a substantial potential to expand. The management aims to stop their spread into new areas, ultimately aiming to decrease their overall distribution.

**Regional Containment/Control:** Species that are either high-risk and already well-established, or medium-risk with a high potential for spreading. The management goal is to halt their further spread within the region by setting up containment boundaries and controlling any occurrences beyond these lines.

**Management:** Species that are widespread but could pose issues in particular scenarios or places of high value, such as conservation lands or specific crops. The management aim is to lessen the local or regional impacts of these invasive species, provided resources are available.

In British Columbia, there are nearly 1,000 of these invasive species. Most are plants, but there are also animals like fish and insects. Although not all of these species are harmful, we don't fully understand their impact yet. These species are found in almost every part of the province, especially in areas with higher populations. Over 175 plant species are known to be invasive and are found in over 117,000 locations across British Columbia. As of 2014, there were 978 established alien species in British Colombia, most of them being plants. Aquatic species have been found in almost all water drainage units in the province. There are over 117,000 locations with invasive plant species, with some areas having more than others. The most common invasive plants are spotted knapweed, Canada thistle, common tansy, and oxeye daisy. Some species are less common, with 36 known to exist in 10 or fewer locations.

The shipping industry has been identified as a significant contributor to the spread of invasive species, prompting international and national actions. In 2004, the International Maritime Organization (IMO) initiated the International Convention for the Control and Management of Ships’ Ballast Water and Sediments, which came into effect in 2017. This convention prompted Canada to enact its own regulations in 2006 under the Canada Shipping Act, 2001, known as the Ballast Water Control and Management Regulations. These were updated in 2021 to impose stricter requirements on ships, aligning more closely with American ballast water regimes. As per these regulations, ships are mandated to manage their ballast water by either treating it through various mechanical, physical, chemical, or biological processes or by exchanging coastal or fresh water with open-ocean water during their voyage. This helps limit the transfer of invasive species from one coastal ecosystem to another. A further concern is biofouling, where marine organisms attach themselves to the hull of the ship. To mitigate this, innovative solutions such as applying anti-fouling paint on submerged surfaces, using biofouling-resistant materials, implementing marine growth prevention systems, and conducting regular hull cleanings are being employed. Even though Canada currently lacks specific domestic regulations for biofouling, it recognizes the threat it poses and is actively working on preventive measures.

Given the significant ecological and economic impacts of invasive species in British Columbia, it's crucial that we prioritize prevention, early detection, and rapid response strategies. While measures like herbicide resistance testing and stricter regulations in the shipping industry are steps in the right direction, we need to further invest in research, public education, and international cooperation. By doing so, we can better understand these species, raise awareness about their dangers, and coordinate efforts to halt their spread. Ultimately, preserving our native ecosystems requires a proactive, informed, and collaborative approach.

In conclusion, the issue of invasive species in British Columbia is a complex problem that requires our immediate attention and action. These uninvited guests, whether plant or animal, pose significant threats to our native ecosystems, economies, and potentially our health. As we've seen from the perspectives of Dr. Bae and the government's risk assessment process, the key to managing this issue lies in understanding the nature of these species, preventing their introduction, and responding swiftly when they're detected.

The call to action is clear: we must invest more in research, public education, and international cooperation to combat this ecological crisis. We cannot afford to underestimate the impact of these invaders. As our understanding of invasive species grows, so too should our commitment to preserving the rich biodiversity that defines British Columbia. The future of our province's ecosystems hangs in the balance, and we hold the power to tip the scales back in favor of our native species.

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